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(54) Title: IDENTIFICATION OF HAZARDOUS NATURE OF UNKNOWN MATERIALS

(57) Abstract

Means are provided to identify environmental hazards of unknown chemicals by people unskilled in chemistry, e.g. firemen and policemen who often have to deal with spillages of unknown chemicals in e.g. road accidents. The hazards are classified as corrosiveness, explosiveness, flammability and toxicity. A portable kit is provided and colour changes of chemical agents is the preferred means of showing the presence of a hazard. Some of the agents are new, and are claimed *per se*.

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IDENFICATION OF HAZARDOUS NATURE OF UNKNOWN MATERIALS

This invention is concerned with the identification of the hazardous nature of unidentified materials, usually solids or liquids or mixtures thereof. Typical examples of areas of use of the invention are spillages of materials from road vehicles e.g. tankers, checking water supplies, trade effluent and waste tips, unknown materials in stores, warehouses etc.

Techniques exist to identify the hazardous nature of unidentified materials and these are based on first identifying the material itself and then from that information consulting the text-books to learn of the associated hazards. These operations can however be time-consuming, require skilled people to carry them out and can often only be done in a laboratory.

So far as is known, the only example of a test kit for use by unskilled laboratory technicians to identify the hazardous nature of an unknown material is disclosed in British patent specification 1 388 221, which provides a kit for a layman to identify a narcotic or psychotropic substance e.g. hashish, cocaine, opium, heroin etc. In that kit the material is reacted with a test strip impregnated with a reagent solution and the substance identified according to the presence and degree of a colour change.

It might be thought that the HAZCHEM code of a composite label would have solved the problem. However this is not the case since, in Great Britain at least, the code is only compulsory for certain vehicles and in many countries no code is available at all.

The invention is based on the realisation that very often the first person required to handle an unknown material lacks the appropriate skills to identify the material and its hazards and there is a need to provide him with some means of identifying the hazards so that he can treat the material appropriately. For example, when a fireman first meets an unknown spilt liquid he needs to know whether he can wash it into the drains without health risks to the population irrespective of whether the liquid contains lead, nickel, copper, arsenic, antimony, bismuth or chromate. He also needs this information quickly, and cannot delay until a sample is analysed by a skilled technician in a laboratory.

According to the invention there are provided means for identifying the presence of an environmental hazard in an unknown material and suitable for use by operatives not skilled in chemistry e.g. firemen, policemen, is characterised by a plurality of agents each adapted to interact with a material having a particular hazard to give an indication of the presence or absence of that hazard.

Most preferably according to the invention, the agents are adapted to give a visual indication of the presence of the hazard, especially in the form of a pronounced colour change.

The agents are preferably adapted to indicate the following hazards

a) whether the material is corrosive
b) whether the material will react with water in a hazardous way
c) whether the material is flammable or explosive
d) whether the material is poisonous

Agents for determining these hazards are preferably as follows:

To test for corrosiveness, use is made of water (especially in the

case of solids) and also of a test paper (called paper E) comprising a filter paper impregnated with indicator dyes adapted to indicate the presence of acids stronger than about pH 2, alkalis stronger than pH 12, bleaches and a reducing poison. It has been discovered that Titan Yellow and Metanil Yellow, are both suitable in this context and surprisingly that when the Metanil Yellow is of a low level of activity unless they are used in substantially equal quantities and deposited together from an aqueous solution, the desired indicator reactions will not be obtained. For the most dramatic colour change it is preferable to have more Titan Yellow present. With such a paper, a violently corrosive material will make the paper go black, char or dissolve while many corrosive poisons will make the paper change to a brown tan colour, a corrosive bleach will make the paper change to white, a corrosive acid will make the paper change to a violet-purple colour and a corrosive caustic will make the paper change to an orange red colour.

The reaction with water can be tested using a sample of the unknown material with water in a vial supplied with the kit. Liquids which are immiscible in water and float upon water may be regarded as likely to be flammable while liquids which are immiscible and sink beneath the water are likely to be organic poisons.

Separate tests are used to determine the flammable or explosive nature of a solid or a liquid. In the case of a solid, flammability can be tested by contacting a small portion with a direct flame, preferably from a low pressure gas lighter e.g. as supplied with the kit. It is much preferred that the lighter be one which can be operated by a button since this can be done easily even when the operator, as recommended, is wearing gloves. In the case of a liquid, some of the liquid may be applied to a glass fibre strip which is exposed to the flame, and the behaviour on burning will indicate a fire hazard.

To test for explosive risk, use is made, according to the invention, of an especially modified test tube having adjacent the lower end a hole in its wall to act as a vent for explosive forces. The small sample is put into the test tube which is then heated with the hole uppermost and a sudden flash, puff of smoke, or pop will indicate an explosive risk. It is also important to identify materials which have the ability to oxidise and which thereby aid or initiate fires in combustible materials. A suitable agent comprises a filter paper impregnated with e.g. starch and iodide and which when wet and in the presence of an oxidising agent goes blue, violet or purple.

To test for poisons which are those most likely to be encountered and the specific nature thereof, reliance can be made on the results of test embodying well-known chemical principles for example the formation of sulphide precipitates by heavy metal poisons, the Prussian blue test for cyanides, and the ferric chloride reaction with phenols. From time to time however other agents to identify poisons which presently are unusual may be included. The invention preferably includes means for the identification of the presently important groups of poisons. In addition use is made according to the invention of further test papers, and as follows:

Test paper "H" comprising a glass fibre filter paper impregnated with a copper sulphate solution will, when wetted by halocarbons and/or nitrogen containing organics such as aryl amines and nitriles, give a low pressure gas flame a distinctive purple colour indicative of an organic poison vapour.

Test paper "M" comprising a glassfibre filter paper impregnated with sodium acetate or the like in aqueous solution and a colour strip of p-dimethylaminobenzylidene-rhodanine deposited from solution in acetone will when exposed to aqueous solution containing mercury give a pink to violet colour and the same is sometimes true of silver, gold and platinum compounds.

Given the information about the identity of the hazard then appropriate measures can be recommended.

Preferably the means is provided in the form of a portable kit containing some apparatus by which the operator can take a small sample of the unknown material. In this way the unskilled operator can take a small sample and then withdraw from the possibly hazardous area to perform the tests with less risk of danger. The apparatus preferably is made of a relatively inert material such as polypropylene and is preferably a beaker of the type having a triangular rim by which samples can be scooped up.

Instead of using test tubes which require some skill and a frame in which to stand, use is made of glass flat bottomed vials having a snap fit plastic lid. These may also serve to store samples of materials for later identification.

The invention as thus discussed will not identify radio-active and biological hazards but the kit may include appropriate instruments and reagents to identify these particular hazards. The kit preferably also includes protective covers in the form of gloves, goggles and the like, and sets of instructions, incorporating suitable warning, to protect the operator from the hazards he is seeking to identify.

The invention includes the means as defined, a kit containing such means and a method of testing, as new items of industrial use, Test papers "E", "H" and "M" and a test tube modified as defined.

An embodiment of the invention is illustrated by the following specific embodiment comprising a set of instructions supplied with a kit containing the reagents and for use specifically by firemen.

CONTENTS

MODULE 1 - SOLIDS

1.0 OBSERVATION

Approach with care. Take a sample in a plastic beaker for testing. Do NOT enter dust clouds without protective apparatus. Move well away once the sample has been taken.

The following are first indications - warnings of possible hazards. Only the subsequent tests are positive identification.

Observation	Hazard
Burning sensation in eyes or choking sensation	Corrosive poison - keep away
Bitter odour	Poison - keep away
Material smoking	Severe fire hazard - keep away
Fibrous appearance	May be asbestos or other harmful silicate
Shiny or metallic	Possible fire hazard Possible poison
Plastic-like	Probable fire hazard

1.1 TEST STRIP E (As defined above)

Moisten one end of test strip - not too wet.
Touch the solid with the strip.
A colour change will develop in about one minute.

Observation	Hazard
Fizzle and/or paper goes black	Strong corrosive Dangerous with water
Violet-Purple	Acid

Orange-Red	Caustic
Brown-Tan	Corrosive poison
White	Corrosive bleach

1.2 WATER (AND CONVERSION TO LIQUID)

Place a little solid in a vial: about as much as would cover a disc, 3 to 4 mm in diameter. Cautiously add water until the vial is half full. If there is a violent reaction, stop immediately. Swirl to mix the solid with the water.

Observation	Instruction
Reacts violently	Dangerous corrosive - keep away from water, keep away from people
Dissolves (even part)	Test liquid in module 2 (see notes)
Floats or sinks, but does not seem to dissolve even partially	Add nitric acid until the vial is about 2/3 full. Swirl, and leave for at least 2 minutes before testing in module 2 (see notes).

NOTES

Leave the mixture in the vial, and carry on with fire hazard tests 1.3 to 1.5. Then use the liquid in the vial for tests 2.4 to 2.6 to determine poison properties. This applies even if none of the solid appears to have dissolved. If the mix is too dark for colour tests to be seen, use module 3 to clarify it before module 2.

If the solid is flammable (tests 1.3 and 1.4) then this test

indicates if water can be used to extinguish a fire. As follows:

Reacts violently	NO
Floats	NO
Dissolves	YES
Sinks	YES

1.3 HEAT - TEST IN A WELL VENTILATED SPACE

Place enough material to cover a dot 3 to 4 mm in diameter in the bottom of one of the modified test-tubes. Hold the tube at an angle of 45 degrees with the side hole upwards. Apply a flame cautiously to the bottom of the tube. Heat more strongly if there is no reaction.

Observation	Hazard
Sudden flash	Explosive
Audible pop or crack	Explosive
Sudden puff of smoke	Explosive
Coloured fumes	Poison fumes on heating

1.4 FLAME I - TEST IN A WELL VENTILATED SPACE

If the solid is in lumps, take a small piece in tweezers and cautiously apply a direct flame. For a powder or sludge, take a nichrome wire in its holder, and place 6 mm to 12 mm into the material so that some sticks to the wire. If necessary, wet the wire, or make a loop. Cautiously apply a direct flame.

Observation	Hazard

Burns easily	Flammable
Burns smokily	Organic poison
Garlic smell	Danger - Arsenic
Fibrous, does not burn or melt	Possibly asbestos or fibreglass
Burns, melts, drips	Flammable - spreads fire

1.5 FLAME TEST II - TEST IN A WELL VENTILATED SPACE

Partly fill vial with clean water. Take a copper wire in its holder and heat in flame for 10 seconds. If the flame is coloured green or blue, the wire is contaminated. Either clean the wire, cut off the end or use new wire. When flame is not coloured, cool wire by dipping into water. Dip into material so that a small amount sticks to wire. Apply flame carefully for 10 to 20 seconds.

Observation	Hazard
Solid burns, then flame goes green or blue	Organic poison
Solid does not burn: flame gives blue flashes	Heavy metal poison
Material seems plastic; gives black smoke: flame goes green	Usually PVC
Solid does not burn: flame goes green	Inorganic poison

MODULE 2 - LIQUIDS

2.0 OBSERVATION

Observe from a distance. Approach cautiously. If any of the poison hazards given below are recognized, withdraw immediately. Take a sample in a plastic beaker for testing, if this can be done safely. Perform all tests well away from the original unknown material.

Observation	Hazard
Visible fumes from cold liquid	Strong corrosive: poison vapour
Acrid or choking smell	Poison vapour
Bad egg smell	Poison vapour - sulphide
Bitter smell	Poison vapour
Sweet smell	Probably flammable
Fruity smell	Probably flammable

2.1 TEST STRIP E (As defined above)

METHOD 1

Touch end of paper to liquid. If no colour develops in one minute, place a drop of water on paper so the two patches meet and wait a further minute for colour to develop.

METHOD 2

If liquid is highly coloured, tarry etc., place one drop on

paper, turn over and look at back of paper for colour development. If no colour change occurs, place one drop of water on back of paper and observe as in Method 1.

Observation	Hazard
Chars black or dissolves	Strong corrosive
Violet-Purple	Acid
Orange-Red	Caustic
Brown-Tan	Corrosive poison
White	Corrosive bleach

2.2 WATER

Half fill a vial with water. Carefully add one drop of liquid using a transfer tube. If there is no violent reaction add several drops more and swirl, not shake.

Observation	Hazard
Violent reaction: fizzle or fumes	Strong corrosive: dangerous with water
Floats, does not mix	Flammable
Sinks, does not mix	Organic poison (poison vapour)
Goes milky	Probably organic: possibly poison, possibly flammable
Mixes	Use test 2.3

2.3 TEST SOLUTION A (Reagent grade NaCl, coloured with rhodamine B)

(Only necessary if the sample mixes or sinks in test 2.2 Otherwise go straight to test 2.4)

Half fill a sample vial with Solution A. Add a few drops of liquid using a transfer tube. Swirl gently.

Observation	Hazard
Floats; does not mix	Flammable organic poison
Sinks; does not mix	Organic poison
Floats, partially mixes (may go milky)	Flammable: (can be diluted with water)
Mixes, going dense white	Probably heavy metal poison
Mixes	Continue testing

2.4 TEST SOLUTIONS B AND C

(B is ferrous sulphate and sulphuric acid and ascorbic acid)
(C is ferric chloride and hydrochloric acid)

Quarter fill a vial with liquid. Add one drop of solution B and swirl. Add two drops of solution C and swirl. Ignore any white cloudiness.

Observation	Hazard
Blue or blue-green colour	Cyanide
Dense black colour	Poison - sulphide

Purple colour	Poison - phenol
Cloudy orange-brown	Caustic - see note

NOTE

Caustic may prevent detection of cyanide. If caustic is indicated, repeat the test as follows:

Add one drop of liquid to a vial. Half fill with nitric acid and swirl. Add one drop of solution B and swirl. Add two drops of solution C and swirl. Blue or green indicates cyanide.

2.5 TEST SOLUTION C (Ferric chloride and hydrochloric acid)

Add one drop of liquid to a sample vial. Half fill with water and swirl. Add two drops of Solution C and swirl. If no reaction, add two more drops of Solution C. If still no reaction, add several drops of unknown liquid, swirling after each drop is added. Ignore any white cloudiness.

Observation	Hazard
Purple colour (may fade)	Phenol
Dense black colour	Sulphide
Red (not orange) solid or cloudiness	Possibly chromate

2.6 TEST SOLUTION D (Sodium sulphide and potassium thiocyanate and sodium acetate and bromothymol blue)

Half fill a vial with liquid. Add two drops of Solution D

and swirl. If no positive reaction, add two more drops and swirl. Ignore any white cloudiness.

Observation	Hazard
Black cloudiness	Heavy metal poison
Black cloudiness, fading to cream	Heavy metal poison
Bright yellow cloudiness	Heavy metal poison
Orange cloudiness	Heavy metal poison
Murky green colour	Poison - chromate
Red colour	Iron (ignore)

2.7 FLAME I - TEST STRIP F (glassfibre filter paper) - TEST IN A WELL VENTILATED SPACE

Wet end of strip with liquid. Holding other end with tweezer not fingers, briefly touch the wetted end with the flame. If it does not catch fire, hold the flame on for longer.

Observation	Hazard
Flares up immediately	Highly flammable
Catches fire	Flammable
Burns with difficulty	Combustible
Black smoke (whether combustible or not)	Organic poison vapour

Green or blue tinge to flame (whether combustible or not)	Heavy metal poison
Red flame	Ignore

2.8 FLAME II - TEST STRIP G (Filter paper) - TEST IN A WELL VENTILATED SPACE

This test is only necessary if there is some doubt about the flammability of the liquid in test 2.7. It detects more subtle fire hazards. Completely wet middle of strip with a drop of liquid. Hold one of the dry ends in tweezers. Set fire to the other end: observe if flame continues through wetted area. If not, repeat, allowing one minute for the strip to partially dry out before applying a flame.

Observation	Hazard
Wetted region burns	Combustible
Flame flares up on wetted and partially dried area	Potentially combustible

2.9 FLAME III - TEST STRIP H (glassfibre filter paper impregnated with copper sulphate) - TEST IN A WELL VENTILATED SPACE

Completely wet one end of the strip with liquid. Hold other end by tweezers. Apply a flame carefully to the wetted end. If the liquid does not burn well, hold the flame on for at least 30 seconds.

Observation	Hazard
Purple colour in flame	Organic poison vapour

Green colour in flame	Ignore

MODULE 3 - SEPARATION OF SOLID AND LIQUID

If it is required to look at the solid and liquid portions of a mixture separately, this technique can be used. It may also be useful if a liquid (either unknown or from test 1.2) is too cloudy for colour changes to be seen: in this case discard the solid and do tests on the separated liquid.

METHOD

1. Remove plunger from syringe.
2. Place one filter disc inside the syringe (do not crease).
3. Gently press disc to bottom with a transfer tube.
4. Add 2 or 3 drops of liquid to wet the disc.
5. Hold the syringe vertical (a support ring is provided). Half fill the syringe with the mixture.
6. Replace the plunger, still keeping the syringe vertical.
7. Carefully depress the plunger, collecting the filtered liquid in a sample vial.
8. Remove the solid and the filter disc from the syringe using the nichrome wire and/or tweezers.
9. Discard the syringe after use.
10. Examine liquid as in MODULE 2.
    Examine solid as in MODULE 1.

MODULE 4 - ADDITIONAL TESTS FOR SPECIFIC IDENTIFICATION

4.1 TEST STRIP M (as defined)

a. FOR LIQUIDS: Hold strip M by the longer white end using tweezers. Touch the other end to the liquid so that it soaks into the paper and rises up into the yellow coloured band.

b. FOR SOLIDS: Convert to liquid as in test 1.2 then test as above.

Observation	Hazard
Pink to violet colour	Mercury

NOTE: Silver, gold and platinum compounds may sometimes give a positive result. They are also poisonous.

4.2 TEST STRIP S (Lead acetate paper)

a. Place a drop of water on end of test strip S. Touch wetted end to solid or liquid. If no positive reaction, then

b. Place one drop of liquid, or a very small piece of solid, in a vial. Place test strip in vial. Add a few drops of nitric acid. Do not inhale fumes.

c. To confirm that an odour of rotten eggs is sulphide, moisten test strip with nitric acid, and leave in the fumes for a while. The more rapid the colour change, the higher the concentration.

Observation	Hazard

Strip goes brown or black	Sulphide

NOTE: Sulphide is as poisonous as cyanide. Avoid breathing fumes at all costs.

4.3 TEST STRIP P (Ether peroxide test stick)

a. ORGANIC LIQUIDS: Dip end of strip with cream pad into liquid for one second. If no colour change, wet the pad with one drop of water and wait a further 30 seconds.

b. WATER MIXTURES: Dip end of strip as above. Colour should appear in 5 seconds.

c. SOLIDS: Half fill a vial with water. Add a little solid and swirl. Wait 3 minutes before testing as in (b).

Observation	Hazard
Turquoise or blue colour	Peroxide
Blue colour turning brown	Peroxide
Rapid green-brown colour	Strong peroxide
Green (from yellow solution)	Peroxide or chromate

FIREMAN'S CHART - SOLIDS

1.0	choking	bitter	smoking
	BA	BA	

1.1	black FULL-V CONTAIN	violet	orange	brown CONTAIN	white FULL
1.2	reacts FULL-V DRY	dissolves FOG	floats FOAM	sinks FOG	
1.3	bang V - E	colour fumes BA for FIRE			
1.4	flares V	burns	garlic BA	black smoke BA for FIRE	
	← FLAMMABILITY →		CONTAIN		
1.5	green CONTAIN	blue CONTAIN	black & green CONTAIN		

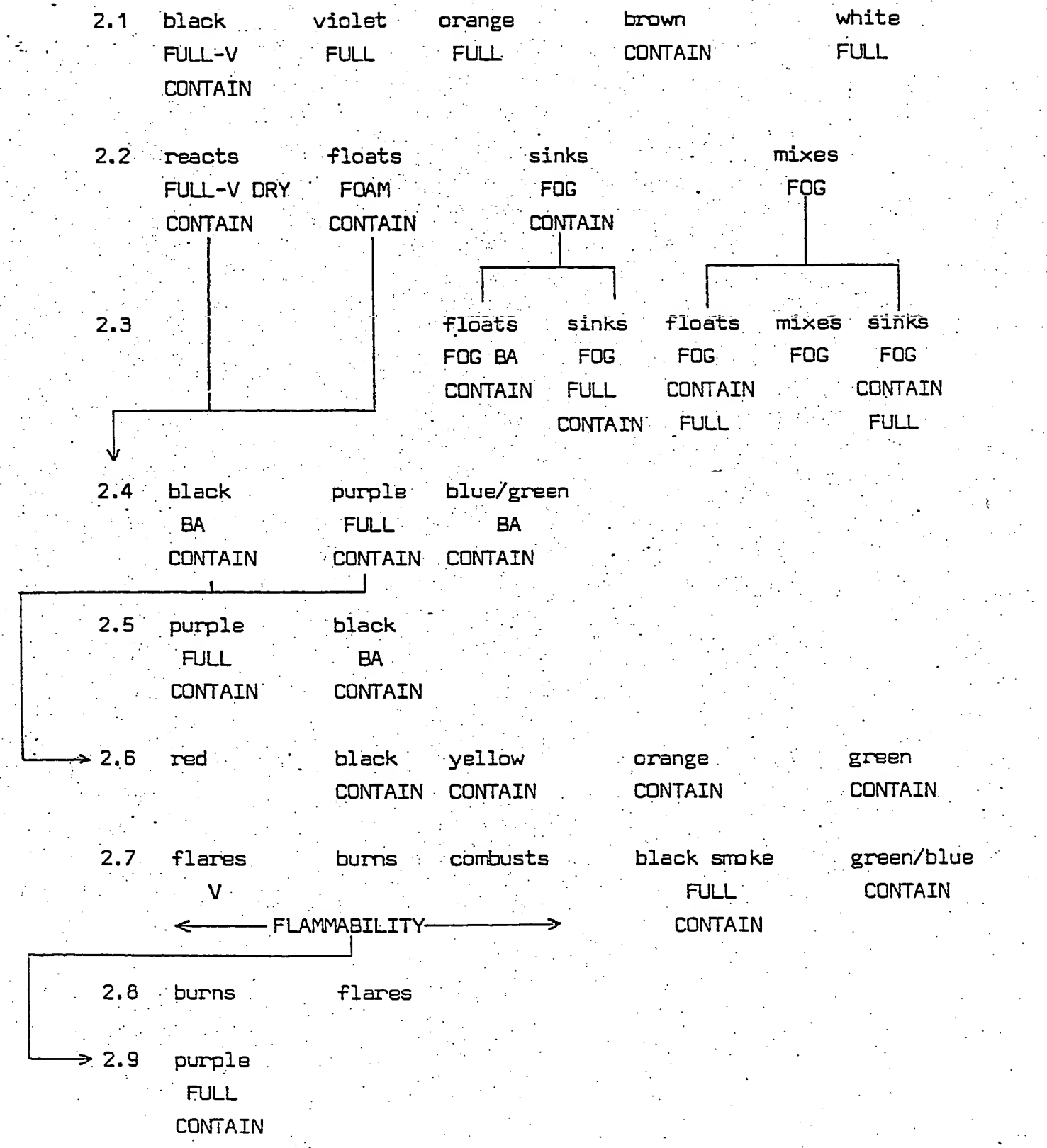
NOTES:

Instruction as from Instructions: in brief -

BA	breathing apparatus
V	violently reactive
E	consider evacuation
FULL	full protective clothing
CONTAIN	prevent from entering drains etc.
FOG, FOAM, DRY	extinguishing agent for fire control

FIREMAN'S CHART - LIQUIDS

2.0	fumes FULL-V CONTAIN	choking BA	bitter BA	bad eggs BA	fruity BA



NOTES

1. Test 2.0 'fumes' initial action until further information is obtained.

2. Test 2.1 'violet, orange, white' if subsequent tests do not give 'contain' then reasonable quantities may be diluted and run to drains. (Notify water authorities.)

3. Test 2.3 'mixes' may be diluted if other tests do not give 'contain'.

CLAIMS:-

1. Means for determining the presence of an environmental hazard in an unknown material and suitable for use by operatives not skilled in chemistry, e.g. firemen, policemen and the like, characterised by a plurality of different agents each adapted to interact with a material having a particular hazard and to give an indication of the presence or absence of that hazard.

2. Means according to Claim 1 characterised in that the agents are adapted to indicate that a material is corrosive, explosive, poisonous or has the ability to oxidise or burn.

3. Means according to Claim 1 or 2 characterised in that at least one agent is adapted to give a visual indication of the presence of the hazard.

4. Means according to Claim 3, characterised in that the visual indication comprises a change of colour.

5. Means according to any of Claims 1 to 4, characterised in that an agent to identify the corrosive nature of an unknown liquid material comprises a filter paper or like substrate impregnated with a mixture of Titan Yellow and Metanil Yellow deposited from an aqueous solution onto the paper.

6. Means according to any of Claims 1 to 5, characterised in that the agent to identify the corrosive nature of an unknown solid material is water.

7. Means according to any of Claims 1 to 6, characterised in that the agent to detect the explosive nature of an unknown material is a flame applied to a sample of the material in a test tube having adjacent the lower end a vent hole in its wall.

8. Means according to any of Claims 1 to 7, characterised in that the agent to detect the poisonous nature of an unknown material is adapted to form with the poisonous material a sulphide, cyanide or phenol-chloride complex.

9. Means according to Claim 8, characterised in that the unknown material is a mercury derivative and the agent to detect the mercury comprises sodium acetate deposited from aqueous solution onto a filter paper or like substrate which also has a colour strip formed of p-dimethylaminobenzylidene rhodamine deposited from solution in acetone, which strip changes colour on contact with mercury.

10. Means according to Claim 8, characterised in that the agent to detect the poisonous nature of an unknown organic material comprises a filter paper or like substrate impregnated with copper sulphate solution.

11. Means according to any of Claims 1 to 3, characterised by an agent adapted to react to the radioactive nature of an unknown material.

12. Means according to any of Claims 1 to 3, characterised by an agent adapted to react to the biologically hazardous nature of an unknown material.

13. A portable container for field use characterised by means according to any of preceding Claims 1 to 12.

14. A portable container according to Claim 13, characterised by the presence of a beaker of a relatively inert plastics material which beaker has a triangular rim.

15. A portable container according to Claim 13 or 14, characterised by the presence of at least one flat bottomed vial having a snap fit lid.

16. A container according to any of Claims 13 to 15, characterised by the lighter operable by a button.

17. A method of testing for the presence of an environmental hazard in an unknown material characterised by reacting the unknown material with a means according to any of Claims 1 to 15.

18. For use as an agent to indicate the presence of a strongly acidic or caustic material, a filter paper or like substrate characterised by being impregnated with a mixture of Titan Yellow and Metanil Yellow deposited from an aqueous solution.

19. For use as an agent to indicate the presence of halo-carbons or nitrogen containing organic compounds, a filter paper or like substrate characterised by being impregnated with a copper sulphate solution.

20. For use as an agent to indicate the presence of mercury, silver, gold, platinum or the like, a filter paper or like substrate characterised by being impregnated with sodium acetate or the like in aqueous solution and having thereon a colour strip comprising p-dimethylaminobenzylidene-rhodamine deposited from solution in acetone.

21. For use in analysis of unknown materials a test tube characterised by having at or adjacent the closed end a vent hole in the side wall.

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 78/00012

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

G 01 N 21/06, G 01 N 21/00, G 01 N 33/00

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
Int.Cl.[2]	G 01 N 21/06, G 01 N 21/14, G 01 N 21/08

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
	US, A, 3672842, published 27th June 1972, see column 2, lines 21-47, W. Florin	1,3,4
	US, A, 3620676, published 16th November 1971, see claims, W.B. Davis	1-6
	US, A, 3979182, published 7th September 1976, see claims, M.D. Zumalt et al.	1
	GB, A, 494882, published 2nd November 1938, see claims, H.T. Ringrose	1
E	US, A, 4092119, published 30th May 1978, see claims, Baier et al.	1
	FR, A, 1010505, published 12th June 1952, see claims, A. Cavasse et al.	1

* Special categories of cited documents: [15]

"A" document defining the general state of the art

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"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention

"X" document of particular relevance

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
2nd February 1979	7th February 1979
International Searching Authority [1]	**Signature of Authorized Officer [20]**
European Patent Office	G. L. M. KRUYDENBERG

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